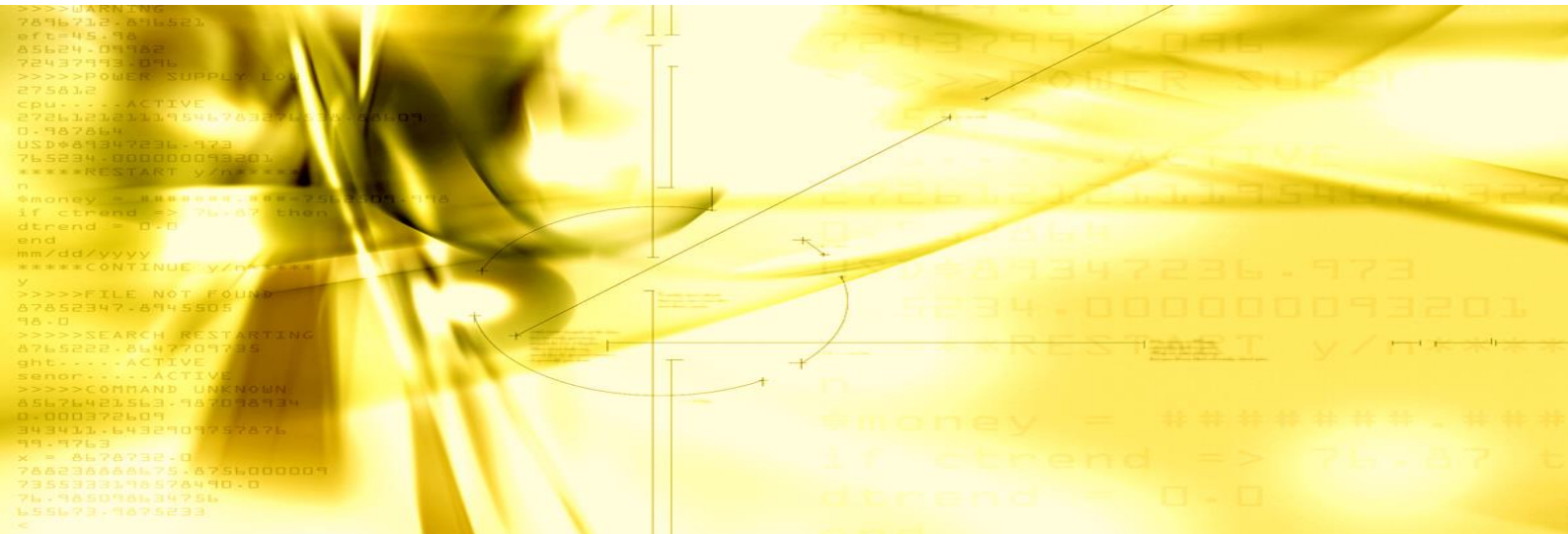


UFG-07 Family

Frame Grabbers



USER MANUAL

Windows® 8

Windows® 7

Windows® XP

 **UNIGRAF**

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The UFG-07 Family frame grabbers meet the essential health and safety requirements, is in conformity with and the CE marking has been applied according to the relevant EU Directives using the relevant section of the corresponding standards and other normative documents. Please find a Declaration of Conformity attached to this document.

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1. ABOUT THIS MANUAL

Purpose

This guide is the User Manual of UFG-07 Family of Frame Grabbers for use in a PC with Windows® 8, Windows® 7 or Windows® XP operating system.

The purpose of this guide is to

- Give an overview of the product and its features.
- Give instruction for the user on how to install the card.
- Give instructions for the user on how to install the related software drivers and libraries in a PC.
- Assist the user in configuring the capturing process with the user interface.
- Give instructions for the user how to capture images.

Product and Driver Version

This manual explains features found in product versions **UFG-07 HS**, **UFG-07 Dual**, **UFG-07 HS Dual** and **UFG-07 STD**

Installation Package version 1.3; Driver version 1.3.3 (Firmware 3.0.1.14). Please consult Unigraf for differences or upgrades of previous versions.

Notes

On certain sections of the manual, when important information or notification is given, text is formatted as follows. Please read these notes carefully.

Note	This text is an important note
------	--------------------------------

2. INTRODUCTION

Product Description

UFG-07 Family board are PCI Express Frame Grabbers capable to capture digital HDMI and DVI, analog RGB and Component Video and also S-Video or Composite Video. The input video performance of the three models is equal; they differ mainly in the PCI bus interface.

- UFG-07 HS; PCI Express 4 lanes (mechanically 8 lane)
- UFG-07 HS Dual; PCI Express 8 lanes, **2 input channels**
- UFG-07 Dual; PCI Express 4 lanes, **2 input channels**
- UFG-07 STD; PCI Express 1 lane

Product Features

- Captures video formats from 640 x 480 to 1920 x 1200. Top-down or bottoms up.
- Auto-detects VESA and CEA HDTV modes, supports CVT timings.
- High capture frame rates achieved by efficient on-board data handling and high speed bus interfaces (pls. refer to product specification for details).
- Optional frame locking (capture 1/1, 1/2, 1/3 or 1/4 of original frame rate)
- In Dual models two fully independent capturing channels, both of which can be HDMI / DVI, RGB / Component or Composite video.
- 64 and 32 bit AVStream drivers (x64, WOW64, X86) that are compatible with DirectShow compatible applications like Media Encoder, VLC, and VirtualDub.
- Supports Microsoft® 7 (32 and 64 bit) and Microsoft® XP (32 bit)
- Function to force default format change for applications that does not have advanced HD Stream Format Dialog
- Supports Power Management on Windows 7 and XP

Identifying Connectors

The UFG-07 HS and UFG-07 STD boards have three connectors on their front panel:

- S-Video connector for S-Video and Composite Video (top)
- DVI-I connector for digital HDMI and DVI input (middle)
- VGA connector (Sub-D 15) for analog RGB and Component Video (bottom)

The UFG-07 HS Dual and UFG-07 HS Dual boards have three connectors on their front panel:

- S-Video connector for two Composite Video inputs (middle)
- Two DVI-I connectors for digital HDMI and DVI input and analog RGB and Component input (top and bottom)

3. INSTALLATION

Unpacking

The UFG-07 family frame grabber product shipment contains

- The UFG-07 card in an anti-static bag
- The Utilities CD containing drivers for Windows operating system along with ready to use sample Windows applications. An electronic copy of this User Manual is included.

Note

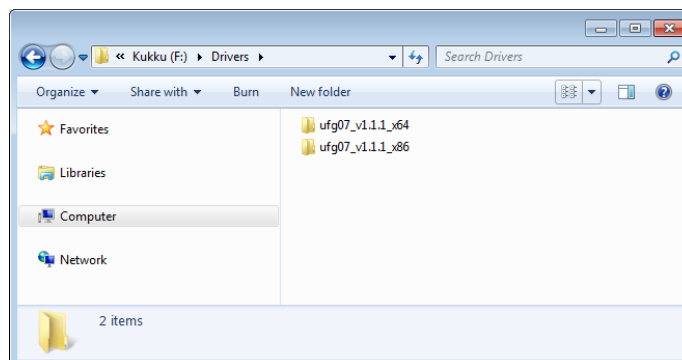
The UFG-07 boards are highly dedicated electronic devices that contain ESD sensitive components. Before opening the anti-static bag and always before touching the card, please be sure to ground yourself. You can do the grounding by wearing a special grounding strap or simply touching a grounded metal surface.

Driver Type Selection

The UFG-07 family supports Microsoft® 7 (32 and 64 bit) and Windows® XP (32 bit) operating systems. The Installation CD includes two alternative drivers:

- **x64** drivers for *64 bit operating system*
- **x86** drivers for *32 bit operating systems*

The two drivers are located in separate folders in the installation CD. Please make sure that you select the proper one for your operating system and the application that you are using.



Driver Installation

- ▶ Power down your PC.
- ▶ Insert UFG-07 card in a vacant PCI slot in your PC.

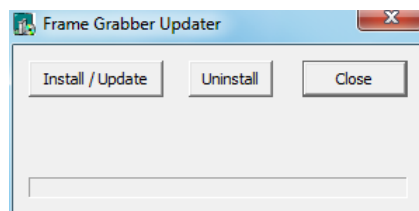
Note: The hardware installation must be done before the software installation.
Please use a PCI Express 1.0 slot.

- ▶ Boot the Windows system and log in

Note: System administrator's privileges are required for performing the installation.

The Plug and Play subsystem will detect the newly installed UFG-07 family board.

- ▶ In the *Welcome to the New Hardware Wizard* click **Cancel**. Please use the *install.exe* routine for pre-installation before the actual Windows installation.
- ▶ Open the folder containing the requested driver type included in the UFG-07 family Installation CD.
- ▶ Run **install.exe** application.
- ▶ Select **Allow** whenever the operating system prompts for permission.

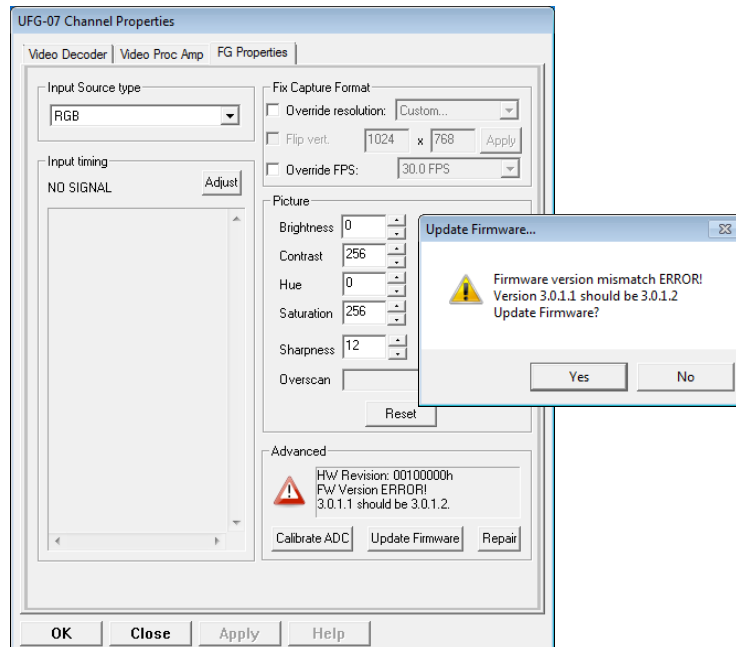


- ▶ In the dialog click **Install/Update**. Press **Continue** and **Apply** whenever the operating system prompts for permission.
- ▶ Click **Close** when the installation is completed. The UFG-07 board is now ready for use.

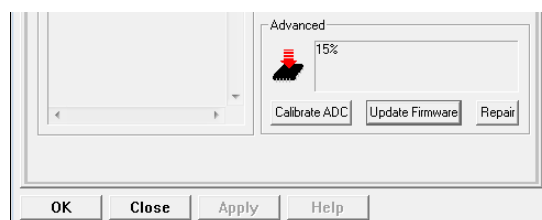
Firmware Update

Please check the firmware version loaded into the non-volatile memory of the board. The firmware version must match to the driver version used.

- ▶ Open the **Capture Filter Properties** dialog of e.g. AmCap tool. Select **FG Properties** tab.
- ▶ The *Advanced* section of the dialog will indicate the mismatch between the firmware and the driver. If a mismatch exists, please click on **Update Firmware** button.
- ▶ If firmware is OK click **No**. If firmware does not match to the driver click **Yes**.



Please note that the firmware update will take about three minutes.



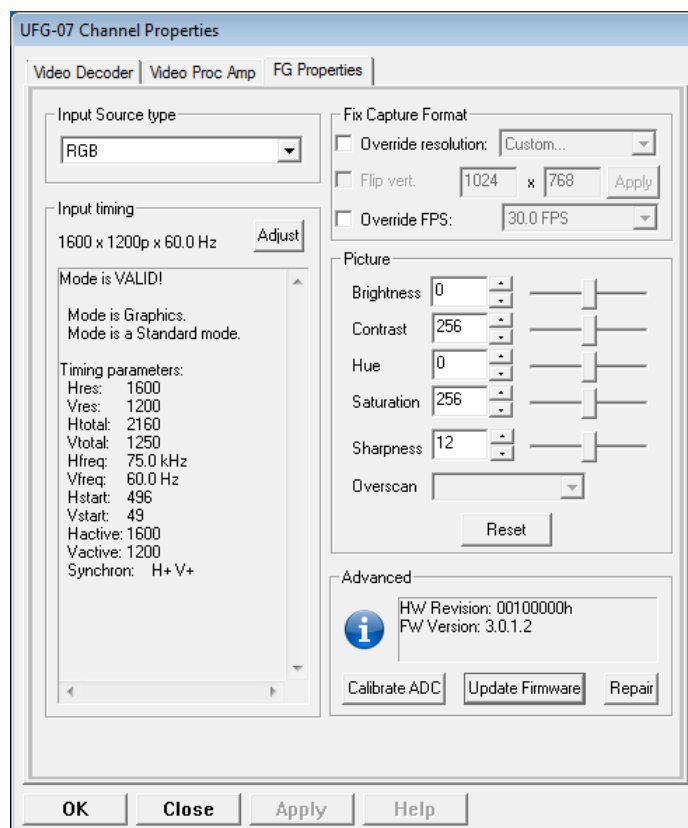
Note: For UFG-07 board to operate properly the driver and the firmware versions have to match.

4. CONFIGURATION

Configuration Dialog

The parameters that describe the input source can be configured by the **Capture Filter Properties** dialog. The dialog contains three tabs: Windows standard *Video Decoder* tab, a *Video Proc Amp* tab and the *FG Properties* tab. All capture properties for UFG-07 can be configured through the *FG Properties* tab.

The controls on the *FG Properties* panel are divided to five functionality sections. Please find below the description each section.



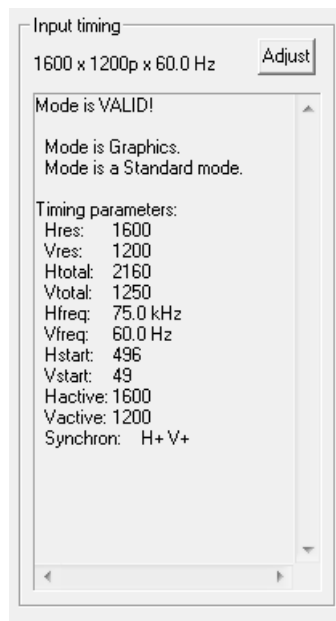
Input Source Type

You can select one of the four input types *DVI/HDMI*, *RGB*, *Component*, *S-Video* and *Video* with *Input Source Type* section. The *Input Timing* section provides slightly varying information for each of the three input types.

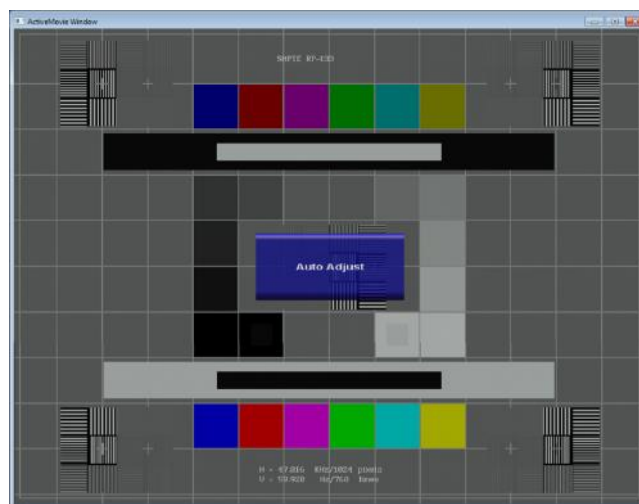
When switching between the Input Source types the last valid values in the *Picture* panel settings are stored.

RGB Input

The timing detection function measures the horizontal and vertical frequencies of the input signal and matches them to known standard timings and timing rules. It also detects the edges of the active video for correct positioning of the image.



Clicking the **Adjust** button you can fine tune the positioning by re-detecting the image boundaries and the sampling phase.

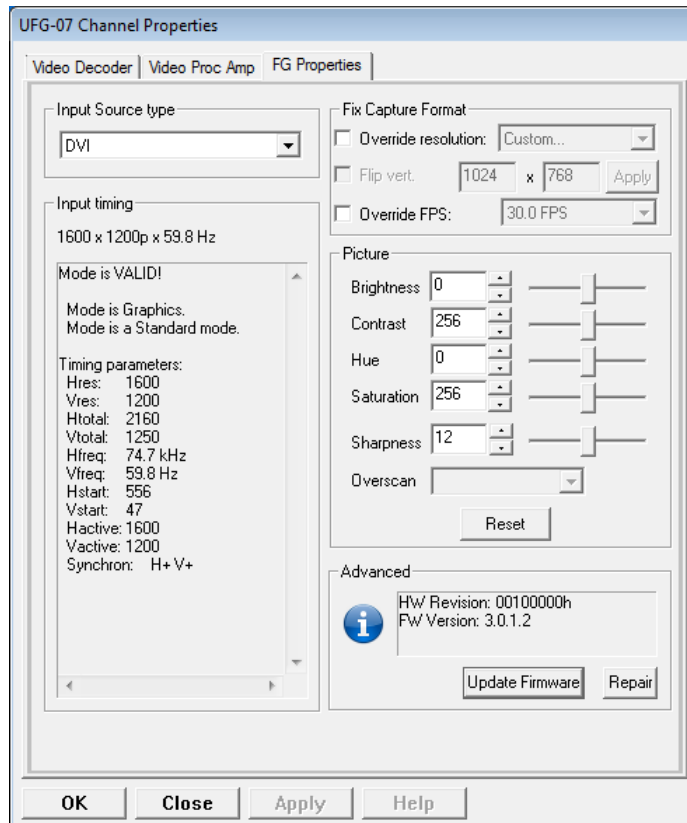


For best results of the positioning please consider the following rules:

- Please use a short and high quality video cable.
- Please use a still image during adjustment (no moving, flickering, etc.)
- Please use an image with light edges.
- Please use an image with sharp vertical edges e.g. black text over white background
- A spread sheet tool or a word processor program maximized to full screen will provide a good image for positioning

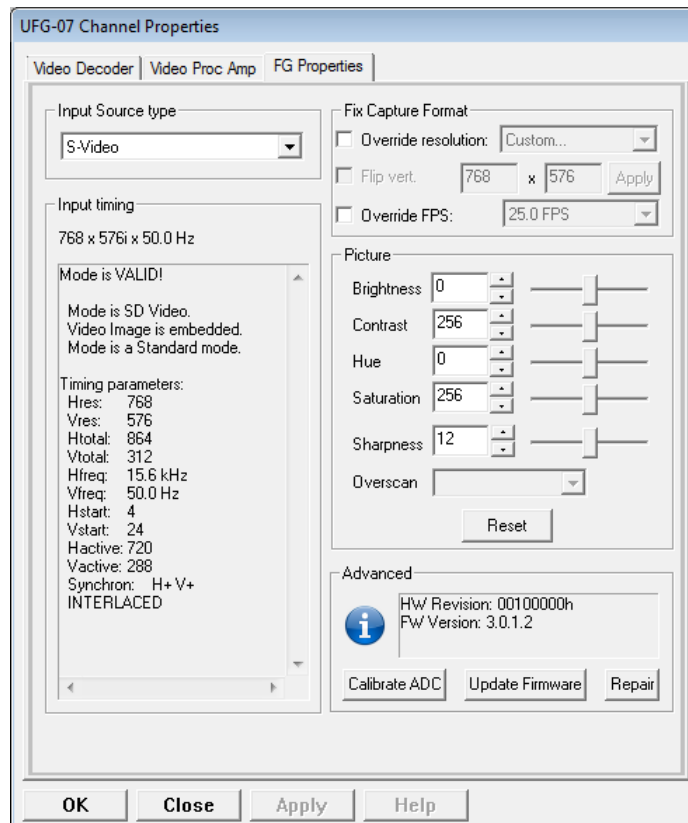
DVI Input

DVI sources are set up automatically and they do not need any detection or calibration procedure.



S-Video and Composite Video

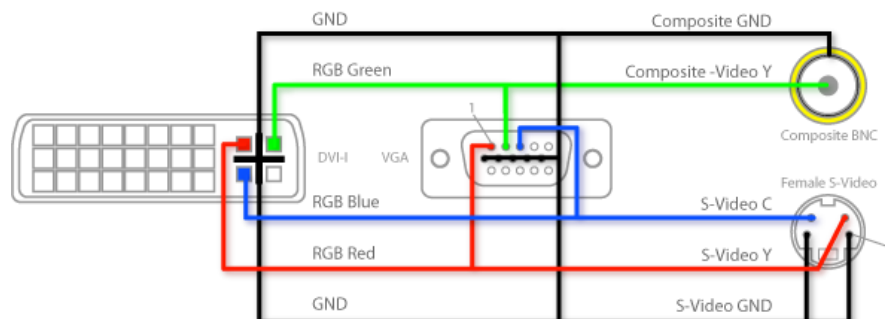
S-Video and Composite Video (CVBS) sources are input through the S-Video Line-In.



In the *Input Source Type* please select **Video** for Composite video and **S-Video** for S-Video type.

The *Input Timing* section shows the detected source timing.

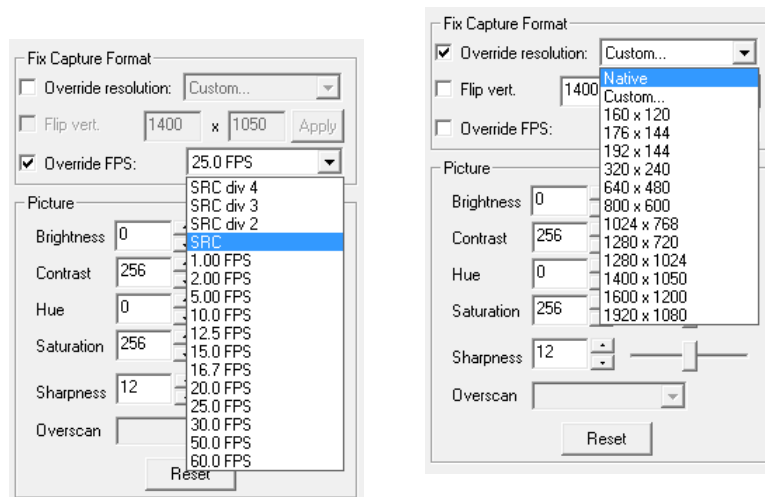
Please find below a schema of the connection of Composite and S-Video signals to the RGB signal inputs of the DVI-I in *UFG-07 Dual* and the corresponding pins in a VGA connector for reference.



Overriding Capture Format

The *Fix Capture Format* section is used for overriding capture frame size and frame rate that UFG-07 capture pin provides for the capturing application.

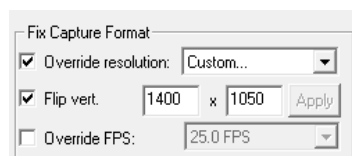
- By selecting the *Override Resolution* checkbox, the dimension selected in the combo-box or the X and Y fields will be forced for the capture pin even if the host application requests another format. The *Apply* button saves the custom values.
- You can frame lock to every 2nd, 3rd or 4th frame of the original video input to save PCI bus bandwidth and ensure a smooth video stream output.
- You can limit the captured frame rate to an arbitrary fps value
- You can control the image orientation when stored in the PC



Note Frame Locking is designed to operate for progressive and interlaced sources with 60 Hz and 50 Hz vertical frequencies and field frequencies respectively.

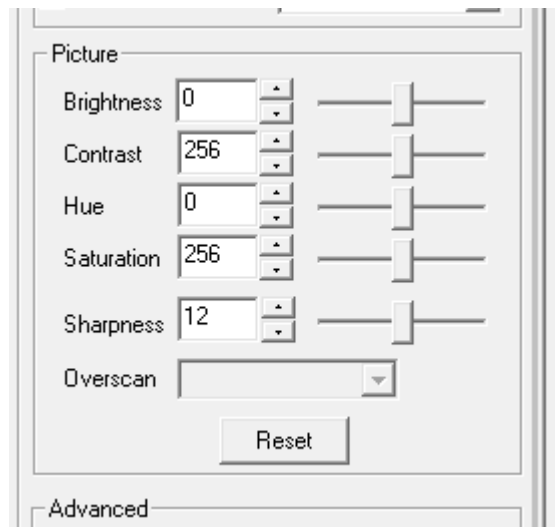
Note You will need over 20 fps capture speed for acceptable quality of moving objects. Please lock 60 Hz input video to 30 fps (SRC/2) or 20 fps FPS (SRC/3) and 50 Hz input video to 25 fps (SRC/2).

You can have the UFG-07 output the captured bitmap flipped around vertically by selecting the **Flip Vert.** check-box. This means that the image is stored upside down. This is the default image for Windows® and some applications operate properly with this format. Please verify if your application accepts the state and leave it unchecked. Please note that *Flip Vert.* is only operational when *Override Resolution* is checked.



Adjusting Captured Colors

The *Picture* section contains controls for adjusting the color information. *Brightness*, *Contrast*, *Hue* and *Saturation* have unique values for all three input types. The values are stored and re-loaded when the corresponding input is selected. The *Reset* button sets the factory default values. In most cases these values give an optimum result.



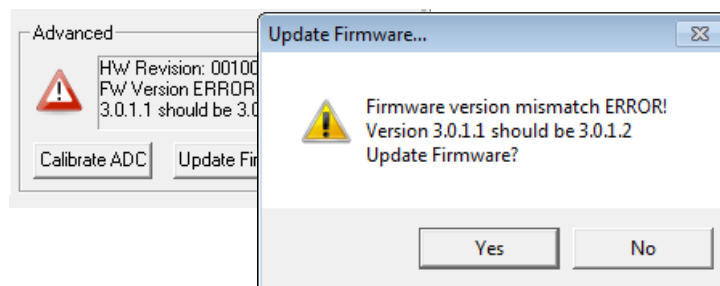
Note: The *Saturation* control is only functional in Component, Composite and S-Video inputs. For RGB input you can additionally turn the captured image in Monochrome mode by sliding the ruler all the way to the left (Saturation = 0). In other positions the slider has no effect in RGB mode.

Advanced Controls

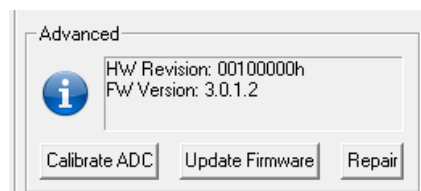
The **Advanced** section contains controls for advanced features of the UFG-07 unit. The user might need the functions after the installation of the unit but not during the normal operation. Please use the features in this section with care. When done improperly, they may impair the correct operation of the UFG-07 unit.

Update Firmware

The on-board firmware version must match the driver version used. If the firmware and the driver do not match, you will be requested to update the firmware. Firmware Update process is described in the *Installation* section earlier in this manual.



Reset



Repair Resets the UFG-07 unit. Not needed in normal operation.

A/D Converter Calibration

The A/D converter of the RGB input can be calibrated by using the **Calib ADC** button. The calibration is done to adjust the variations of the integrated circuits. The A/D converter calibration is done during the initial set-up of the board at Unigraf. The user does not need normally to use this button.

In order to perform the calibration properly, the captured video source needs to fulfill the following requirements:

- The test image source has to be calibrated
- The test image must contain large fully white and fully black areas.
- The test image must contain smooth horizontal transitions.
- Please use a timing that is well detected and adjusted before color calibration
- Please use RGB video mode

Note	A/D converter calibration is done during the initial set-up of the board at Unigraf. The user does not need to perform it with his video sources.
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5. USAGE

The driver software provided with the UFG-07 family frame grabbers is an AVStream WDM driver compatible with standard capturing applications supporting Microsoft® DirectShow®. The driver is built for Microsoft® Windows 7 and XP.

Previewing Video

You may preview the video captured by UFG-07 with applications like *Windows Media Encoder*, *VirtualDUB*, *AmCap*, *GraphEdit*, etc. The driver has been tested with all standard DirectShow renderers.

The UFG-07 appears as a single DirectShow Filter (UFG-07 Channel) under the group Video Capture Sources in GraphEdit

To gain best picture quality do not set 60 Hz for 50 Hz based signals

Use the *Override* settings in the FG properties dialog if you need a custom format. Some applications might need reconfiguration as this setting is applied when the graph is rebuilt.

The SRC, SRC/2, SRC/3, SRC/4 frame rate settings give the best picture quality because they give a *Frame Locked* stream. When you use them, rebuild the graph each time the source frame rate changes. *Frame-locking* works with input signals only that have vertical frequency 50Hz or 60Hz.

When capturing the PCI bus bandwidth might be the bottleneck of the system especially if you use a high performance PCI Express graphics card.

Capturing Video

The UFG-07 driver stores the captured images only as 32-bit RGB bitmaps. In order to generate compressed stream formats a software tool with a compression codec is needed.

You can frame lock to every 2nd, 3rd or 4th frame of the original video input to save PCI bus bandwidth and ensure a smooth video stream output.

When capturing video, the CPU performance or the hard disk storage performance might be the bottleneck of the system.

Applications and Troubleshooting

You might experience some issues in the tested applications. Here are the procedures how to resolve them.

GraphEdit

In GraphEdit insert the filter of the device (usually UFG-07 Channel) to the graph. Right click on the single pin and choose **Render**. Start the graph with the play button.

With GraphEdit SW packet you will receive several rendering filters. Please experiment the performance of various filters in your set-up. *Video Mixing Renderer 9* found in *DirectShow filters* group is a good alternative.

In some cases you may need using a *Color Space Converter* filter. In this case insert *Color Space Converter* filter (please find it *DirectShow Filters* group and re-build the graph. (Click on Capture pin of DXFG filter and drag the end of arrow to point to **Input** pin of *Color Space Converter*. Right-click on **XForm Out** pin and choose **Render Pin** or attach it to the input pin of the selected renderer.

If you want to preview with a custom format, disconnect the graph by clicking on the arrow coming out of the UFG-07 filter and pressing the Del key. Right click on the filter and set the appropriate Override Resolution or Override FPS checkbox with the format. Press OK and reconnect the graph.

If the picture appears upside down follow the previous steps but try to check also the *Flip Vert.* checkbox

AmCap

AmCap is a sample capture application of Windows

If you want to capture to a different resolution than the default, open the *FG Properties* window, check *Override Resolution* and select the desired format. To apply this setting to the preview window open the *Video Capture Pin...* dialog and press Cancel.

If you use the *Override FPS* function in AmCap you cannot set the frame rate in the Capture/Set Frame rate menu.

Windows Media Encoder

Windows Media Encoder is a standard reference application for DirectShow. There are no known issues with the use of UFG-07 with WME.

Please note that WME is very sensitive to CPU performance. When storing to *.wmv file format this might be the bottleneck

VirtualDUB

VirtualDUB is a freeware video capture software application originally written to capture Video for Windows sources. The recent versions are already compatible with DirectShow. The tested version is 1.9.11.

VirtualDUB normally cannot accept top-down RGB images which are default in UFG-07 for performance reasons. To avoid this open the menu **Video > Set Custom Format** and set the Use Custom Size fields to for example 640x480 instead of the default values.

Some VirtualDUB codecs have problems when using with UFG-07 output streams.

Performance

The achieved capture rate depends on several performance factors of the capturing PC and the frame grabber. Some remarks have been mentioned above when reviewing the applications. Some general rules apply to all SW.

Calculating the Requested Bandwidth

When *Previewing* PCIe bandwidth of UFG-07 board will be the performance the bottleneck if you use a modern graphics engine. Especially if GPU is behind a 16-lane PCIe bus

You can calculate the data bandwidth needed to capture certain resolution image with the requested frame rate.

The bandwidth can be calculated using the formula:

$$W = ResX * ResY * FPS * 4 \text{ Bytes},$$

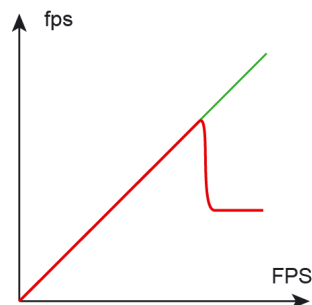
where W is the bandwidth, $ResX$ is the captured horizontal resolution, $ResY$ captured vertical resolution, FPS the captured frame rate (frame per second). For example a 1920 x 1080 signal with 20 fps needs a bandwidth of $1920 * 1080 * 20 * 4 = 158.2$ MBytes/s.

Note: Please note that if you are using the hardware scaling and frame rate reduction with UFG-07, you should calculate the bandwidth with the selected *Override Resolution* and *Override FPS* values instead of the resolution and frame rate of the input video.

Estimating the Bandwidth

You can estimate the current maximum bandwidth of a PC capturing setup by altering the capture parameters and at the same time monitoring the achieved capture performance.

Start with your requested resolution and a low frame rate. Step by step increase the frame rate. At a certain point the achieved frame rate will drop down to only half of the requested frame rate. This point is the current capture bandwidth of the system for that resolution. The following graph illustrates the situation.



The graph above shows the relation of the *Requested Frame Rate* (FPS) and the *Achieved Frame Rate* (fps). On a certain FPS level the achieved fps drops to half of the requested FPS and stays there. The FPS value just below this point provides the optimum performance for the PC capturing setup.

The reason why the achieved fps drops to the half of the requested FPS is based on the way how the PCI bus data transfer occurs.

- During streaming, the application requests a new frame based on the *Requested Frame Rate FPS*. The pace is calculated from the PC real-time clock.
- Everything goes well provided that the whole frame data has been transferred from the frame grabber to the PC before the next request occurs.
- However if the *Requested Rate FPS* is too high, the bus is not ready and the transfer of the following frame is cancelled. A new frame is transferred only on the following request.
- At this point the user sees the *Achieved Frame Rate fps* halved.

Frame Locking

The achieved frame rate is not only dependent on the card to PC bus transfer speed. It is also dependent on the CPU performance, the memory bandwidth and the hard disk data rate specially when capturing non-compressed video.

Please prefer the Frame Locked operation. In this operation mode the hardware provides frames to the application only with a constant rate fixed to the input frame frequency. This enables that the performance variations caused by e.g. software compression will not affect the *Achieved Frame Rate fps*. The result will be a smoother video stream compared to a situation when the *fps* constantly changes.

Other Limitations

Please note that the data bandwidth of an ATA disk is only 40 MBytes/s. Please consider using SATA drives instead.

The CPU performance is a typical bottleneck when creating a compressed video stream. If Windows Media Encoder captures fewer frames than requested, please check the CPU utilization. If it is very high, you should reduce the requested frame rate. Memory bandwidth may also affect CPU utilization.

Special registry setting

The following registry parameter affect the behaviour on how the DFG device handles its parameters:

EnableLoad: DWORD, value 1 enables the driver to load the last configuration at boot time.

Registry key: the registry path of DFG device:

`HKLM\System\CurrentControlSet\Enum\PCI\{VEN_1C04&DEV_0001&SUBSYS_nnnn1C04...}\{ID}\Device Parameters`

where:

nnnn is the subsystem device id, which is either 0010, 0011 or 0012.

{ID}: A random number

APPENDIX A. PRODUCT SPECIFICATION

Analog Video Input

Connector	15-pin Sub-D, 2 x DVI-I for UFG-07 Dual
Color Coding	RGB or YPbPr
Input Resolution Range	640 x 480 to 1920 x 1200
Horizontal Sync Range	45 Hz to 120 Hz Input locking to 50 Hz and 60 Hz
Pixel frequency Range	25 MHz to 165 MHz
Color Depth	8 bits per color
Sync Modes	Automatically detect RGBHV, RGsB, RGBC
Scan Modes	Progressive, interlaced
Video Modes	Please refer to the list of supported video modes

Digital TMDS Video Input

Connector	DVI-I (digital only), 2 x DVI-I for UFG-07 Dual
Color Coding	RGB or YCbCr
Input Resolution Range	640 x 480 to 1920 x 1200, automatic detection
Horizontal Sync Range	45 Hz to 120 Hz Input locking to 50 Hz and 60 Hz
Pixel Frequency Range	25 MHz to 160 MHz
Color Depth	8 bits per color component

S-Video and Composite Video Input

Connector	S-Video Connector, Integrated to RGB pins of DVI-I in UFG-07 Dual
Supported standards	PAL, NTSC, B/W. Automatic wide screen detection

HW Features

PCI bus	PCI Express 1.0 UFG-07 HS: PCIe 4 lanes (8 lanes mechanically), UFG-07 HS Dual: 8 PCIe lanes UFG-07 Dual: PCIe 4 lanes (8 lanes mechanically), UFG-07 STD: 1 PCIe lane
Capture Quality	Hardware driven frame rate Capable to lock to input frequency (50 Hz, 60 Hz) Capability to get every 2nd, 3rd, 4th frames No busy wait. The capture and the control thread do not stall the CPU for significant times. Sync checking and notification.

Driver Properties

Operating Systems	Windows® 7 (64 and 32 bit), and XP (32 bit)
SW Interface	64 and 32 bit AVStream drivers (x64, WOW64, X86) drivers with configuration dialog
Output Format	RGB32. Top down or vertically inverted
Power Management	Supports Power Management on Win 8, 7 and XP
User Functions	Allows setting manual timings. Adjustable Brightness, Contrast, Hue, Saturation separate for all three input types. Function to force default format change for applications that do not have advanced HD Stream Format Dialog. External firmware update capable
Compatibility	Tested with common applications as AmCap, Windows Media Encoder, Graphedit and VirtualDUB, VLC etc

General

Module Size	UFG-07 HS: 146 x 97 mm UFG-07 HS Dual: 257 x 105 mm UFG-07 STD: 146 x 97 mm UFG-07 Dual: 194 x 105 mm
Power Consumption	UFG-07 HS: 6.5 W UFG-07 STD: 5.7 W

APPENDIX B. SUPPORTED VIDEO MODES

Supported TMDS signal timings / standards

Mode	Horizontal Frequency	Pixel Frequency	Standard
640 x 350 @ 85Hz	37.9 kHz	31.5 MHz	DMT ID 01h
640 x 400 @ 85Hz	37.9 kHz	31.5 MHz	DMT ID 02h
720 x 400 @ 85Hz	37.9 kHz	35.5 MHz	DMT ID 03h
640 x 480 @ 60Hz	31.5 kHz	25.175 MHz	DMT ID 04h
640 x 480 @ 72Hz	37.9 kHz	31.5 MHz	DMT ID 05h
640 x 480 @ 75Hz	37.5 kHz	31.5 MHz	DMT ID 06h
640 x 480 @ 85Hz	43.3 kHz	36.0 MHz	DMT ID 07h
800 x 600 @ 56Hz	35.23 kHz	36.0 MHz	DMT ID 08h
800 x 600 @ 60Hz	37.9 kHz	40.0 MHz	DMT ID 09h
800 x 600 @ 72Hz	48.1 kHz	50.0 MHz	DMT ID 0Ah
800 x 600 @ 75Hz	46.9 kHz	49.5 MHz	DMT ID 0Bh
800 x 600 @ 85Hz	53.7 kHz	56.25 MHz	DMT ID 0Ch
800 x 600 @ 120Hz RB	76.3 kHz	73.25 MHz	DMT ID 0Dh
848 x 480 @ 60Hz	31.0 kHz	33.75 MHz	DMT ID 0Eh
1024 x 768 @ 60Hz	48.4 kHz	65.0 MHz	DMT ID 10h
1024 x 768 @ 70Hz	56.5 kHz	75.0 MHz	DMT ID 11h
1024 x 768 @ 75Hz	60.0 kHz	78.75 MHz	DMT ID 12h
1024 x 768 @ 85Hz	68.7 kHz	94.5 MHz	DMT ID 13h
1024 x 768 @ 120Hz RB	97.6 kHz	115.5 MHz	DMT ID 14h
1152 x 864 @ 75Hz	67.5 kHz	108.0 MHz	DMT ID 15h
1280 x 768 @ 60Hz RB	47.4 kHz	68.25 MHz	DMT ID 16h
1280 x 768 @ 60Hz	47.8 kHz	79.5 MHz	DMT ID 17h
1280 x 768 @ 75Hz	60.3 kHz	102.25 MHz	DMT ID 18h
1280 x 768 @ 85Hz	68.6 kHz	117.5 MHz	DMT ID 19h
1280 x 768 @ 120Hz RB	97.4 kHz	140.25 MHz	DMT ID 1Ah
1280 x 800 @ 60Hz RB	49.3 kHz	71.0 MHz	DMT ID 1Bh
1280 x 800 @ 60Hz	49.7 kHz	83.5 MHz	DMT ID 1Ch
1280 x 800 @ 75Hz	62.8 kHz	106.5 MHz	DMT ID 1Dh
1280 x 800 @ 85Hz	71.6 kHz	122.5 MHz	DMT ID 1Eh
1280 x 800 @ 120Hz RB	101.6 kHz	146.25 MHz	DMT ID 1Fh
1280 x 960 @ 60Hz	60.0 kHz	108.0 MHz	DMT ID 20h
1280 x 960 @ 85Hz	85.9 kHz	148.5 MHz	DMT ID 21h
1280 x 1024 @ 60Hz	64.0 kHz	108.0 MHz	DMT ID 23h
1280 x 1024 @ 75Hz	80.0 kHz	135.0 MHz	DMT ID 24h
1280 x 1024 @ 85Hz	91.1 kHz	157.7 MHz	DMT ID 25h
1360 x 768 @ 60Hz	47.7 kHz	85.5 MHz	DMT ID 27h
1360 x 768 @ 120Hz RB	97.5 kHz	148.25 MHz	DMT ID 28h
1400 x 1050 @ 60Hz RB	64.7 kHz	101.0 MHz	DMT ID 29h
1400 x 1050 @ 60Hz	65.3 kHz	121.75 MHz	DMT ID 2Ah

1400 x 1050 @ 75Hz	82.3 kHz	156.0 MHz	DMT ID 2Bh
1440 x 900 @ 60Hz RB	55.5 kHz	88.75 MHz	DMT ID 2Eh
1440 x 900 @ 60Hz	55.9 kHz	106.5 MHz	DMT ID 2Fh
1440 x 900 @ 75Hz	70.6 kHz	136.75 MHz	DMT ID 30h
1440 x 900 @ 85Hz	80.4 kHz	157.0 MHz	DMT ID 31h
1600 x 1200 @ 60Hz	75.0 kHz	162.0 MHz	DMT ID 33h
1680 x 1050 @ 60Hz RB	64.7 kHz	119.0 MHz	DMT ID 39h
1680 x 1050 @ 60Hz	65.3 kHz	146.25 MHz	DMT ID 3Ah
1920 x 1200 @ 60Hz RB	74.0 kHz	154.0 MHz	DMT ID 44h
1366 x 768 @ 60Hz	47.7 kHz	85.5 MHz	DMT ID 51h
1920 x 1080 @ 60Hz	67.5 kHz	148.5 MHz	DMT ID 52h
640 x 480 @ 59.94Hz	31.469 kHz	25.175 MHz	CEA-861-E VIC 1
720 x 480 @ 59.94Hz	31.469 kHz	27.0 MHz	CEA-861-E VIC 2, 3
1280 x 720 @ 60Hz	45.0 kHz	74.25 MHz	CEA-861-E VIC 4
1920 x 1080i @ 60Hz	33.75 kHz	74.25 MHz	CEA-861-E VIC 5 *
1440 x 480i @ 59.94Hz	15.734 kHz	27.0 MHz	CEA-861-E VIC 6, 7 *
1440 x 240 @ 60Hz	15.734 kHz	27.0 MHz	CEA-861-E VIC 8, 9 *
1440 x 480 @ 59.94Hz	31.469 kHz	54.0 MHz	CEA-861-E VIC 14, 15
1920 x 1080 @ 60 Hz	67.5 kHz	148.5 MHz	CEA-861-E VIC 16
720 x 576 @ 50Hz	31.25 kHz	27.0 MHz	CEA-861-E VIC 17, 18
1280 x 720 @ 50Hz	37.5 kHz	74.25 MHz	CEA-861-E VIC 19
1920 x 1080i @ 50Hz	28.125 kHz	74.25 MHz	CEA-861-E VIC 20 *
1440 x 576i @ 50Hz	15.625 kHz	27.0 MHz	CEA-861-E VIC 21, 22 *
1440 x 288 @ 50Hz	15.625 kHz	27.0 MHz	CEA-861-E VIC 23, 24 *
1440 x 576 @ 50Hz	31.25 kHz	54.0 MHz	CEA-861-E VIC 29, 30
1920 x 1080 @ 24Hz	27.0 kHz	74.25 MHz	CEA-861-E VIC 32
1920 x 1080 @ 25Hz	28.125 kHz	74.25 MHz	CEA-861-E VIC 33
1920 x 1080 @ 30Hz	33.75 kHz	74.25 MHz	CEA-861-E VIC 34
All the CVT compliant timings that have pixel frequency <= 174 MHz			

* with over scan

Supported RGB signal timings / standards

Mode	Horizontal Frequency	Pixel Frequency	Standard
640 x 350 @ 85Hz	37.9 kHz	31.5 MHz	DMT ID 01h
640 x 400 @ 85Hz	37.9 kHz	31.5 MHz	DMT ID 02h
640 x 480 @ 60Hz	31.5 kHz	25.175 MHz	DMT ID 04h
640 x 480 @ 72Hz	37.9 kHz	31.5 MHz	DMT ID 05h
640 x 480 @ 75Hz	37.5 kHz	31.5 MHz	DMT ID 06h
640 x 480 @ 85Hz	43.3 kHz	36.0 MHz	DMT ID 07h
800 x 600 @ 56Hz	35.23 kHz	36.0 MHz	DMT ID 08h
800 x 600 @ 60Hz	37.9 kHz	40.0 MHz	DMT ID 09h
800 x 600 @ 72Hz	48.1 kHz	50.0 MHz	DMT ID 0Ah
800 x 600 @ 75Hz	46.9 kHz	49.5 MHz	DMT ID 0Bh
800 x 600 @ 85Hz	53.7 kHz	56.25 MHz	DMT ID 0Ch
800 x 600 @ 120Hz RB	76.3 kHz	73.25 MHz	DMT ID 0Dh
848 x 480 @ 60Hz	31.0 kHz	33.75 MHz	DMT ID 0Eh
1024 x 768 @ 60Hz	48.4 kHz	65.0 MHz	DMT ID 10h
1024 x 768 @ 70Hz	56.5 kHz	75.0 MHz	DMT ID 11h
1024 x 768 @ 75Hz	60.0 kHz	78.75 MHz	DMT ID 12h
1024 x 768 @ 85Hz	68.7 kHz	94.5 MHz	DMT ID 13h
1024 x 768 @ 120Hz RB	97.6 kHz	115.5 MHz	DMT ID 14h
1152 x 864 @ 75Hz	67.5 kHz	108.0 MHz	DMT ID 15h
1280 x 768 @ 60Hz RB	47.4 kHz	68.25 MHz	DMT ID 16h
1280 x 768 @ 60Hz	47.8 kHz	79.5 MHz	DMT ID 17h
1280 x 768 @ 75Hz	60.3 kHz	102.25 MHz	DMT ID 18h
1280 x 768 @ 85Hz	68.6 kHz	117.5 MHz	DMT ID 19h
1280 x 768 @ 120Hz RB	97.4 kHz	140.25 MHz	DMT ID 1Ah
1280 x 800 @ 60Hz RB	49.3 kHz	71.0 MHz	DMT ID 1Bh
1280 x 800 @ 60Hz	49.7 kHz	83.5 MHz	DMT ID 1Ch
1280 x 800 @ 75Hz	62.8 kHz	106.5 MHz	DMT ID 1Dh
1280 x 800 @ 85Hz	71.6 kHz	122.5 MHz	DMT ID 1Eh
1280 x 800 @ 120Hz RB	101.6 kHz	146.25 MHz	DMT ID 1Fh
1280 x 960 @ 60Hz	60.0 kHz	108.0 MHz	DMT ID 20h
1280 x 960 @ 85Hz	85.9 kHz	148.5 MHz	DMT ID 21h
1280 x 1024 @ 60Hz	64.0 kHz	108.0 MHz	DMT ID 23h
1280 x 1024 @ 75Hz	80.0 kHz	135.0 MHz	DMT ID 24h
1280 x 1024 @ 85Hz	91.1 kHz	157.7 MHz	DMT ID 25h
1360 x 768 @ 60Hz	47.7 kHz	85.5 MHz	DMT ID 27h
1360 x 768 @ 120Hz RB	97.5 kHz	148.25 MHz	DMT ID 28h
1400 x 1050 @ 60Hz RB	64.7 kHz	101.0 MHz	DMT ID 29h
1400 x 1050 @ 60Hz	65.3 kHz	121.75 MHz	DMT ID 2Ah

1400 x 1050 @ 75Hz	82.3 kHz	156.0 MHz	DMT ID 2Bh
1440 x 900 @ 60Hz RB	55.5 kHz	88.75 MHz	DMT ID 2Eh
1440 x 900 @ 60Hz	55.9 kHz	106.5 MHz	DMT ID 2Fh
1440 x 900 @ 75Hz	70.6 kHz	136.75 MHz	DMT ID 30h
1440 x 900 @ 85Hz	80.4 kHz	157.0 MHz	DMT ID 31h
1600 x 1200 @ 60Hz	75.0 kHz	162.0 MHz	DMT ID 33h
1680 x 1050 @ 60Hz RB	64.7 kHz	119.0 MHz	DMT ID 39h
1680 x 1050 @ 60Hz	65.3 kHz	146.25 MHz	DMT ID 3Ah
1920 x 1200 @ 60Hz RB	74.0 kHz	154.0 MHz	DMT ID 44h
1366 x 768 @ 60Hz	47.7 kHz	85.5 MHz	DMT ID 51h
1920 x 1080 @ 60Hz	67.5 kHz	148.5 MHz	DMT ID 52h
640 x 480 @ 59.94Hz	31.469 kHz	25.175 MHz	CEA-861-E VIC 1
720 x 480 @ 59.94Hz	31.469 kHz	27.0 MHz	CEA-861-E VIC 2, 3
1280 x 720 @ 60Hz	45.0 kHz	74.25 MHz	CEA-861-E VIC 4
1920 x 1080i @ 50Hz	28.125 kHz	74.25 MHz	CEA-861-E VIC 20 *
1920 x 1080 @ 60 Hz	67.5 kHz	148.5 MHz	CEA-861-E VIC 16
720 x 576 @ 50Hz	31.25 kHz	27.0 MHz	CEA-861-E VIC 17, 18
1280 x 720 @ 50Hz	37.5 kHz	74.25 MHz	CEA-861-E VIC 19
1920 x 1080 @ 24Hz	27.0 kHz	74.25 MHz	CEA-861-E VIC 32
1920 x 1080 @ 25Hz	28.125 kHz	74.25 MHz	CEA-861-E VIC 33
1920 x 1080 @ 30Hz	33.75 kHz	74.25 MHz	CEA-861-E VIC 34
1920 x 1080 @ 50Hz	51 kHz	27.0 MHz	SMPTE 274M[2]
All the CVT compliant timings that have pixel frequency <= 174 MHz			

* with over scan

Supported YPbPr signal timings / standards

Mode	Vertical Frequency	Interlaced / Progressive	Reference Standard
480i	59.94 Hz	Interlaced	CEA-770.2-D[31]
480p	59.94 Hz	Progressive	CEA-770.2-D[31]
720p	60 Hz	Progressive	CEA-770.3-C[32]
1080i	60 Hz	Interlaced	CEA-770.3-C[32]
1080p	60 Hz	Progressive	SMPTE 274M[2]
576i	50 Hz	Interlaced	ITU-R BT.656-4[54]
576p	50 Hz	Progressive	ITU-R BT.1358[56]
720p	51 Hz	Progressive	SMPTE 296M[40]
1080i	51 Hz	Interlaced	SMPTE 274M[2]
1080p	51 kHz	Progressive	SMPTE 274M[2]